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May 6, 1998

EX PARTE

BY HAND
Magalie Roman Salas
Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, D.C. 20554

Re: In the Matter of Universal Service - Report to Congress -- CC Docket No. 96-45

Dear Ms. Salas:

On May 6, 1998, on behalf of America Online, Inc. ("AOL"), a copy of the attached document was provided to Chairman Kennard, Commissioner Michael Powell, Commissioner Gloria Tristani, Commissioner Susan Ness, and Commissioner Harold Furchtgott-Roth.

Pursuant to Section 1.1206(a)(1) of the Commission's Rules, two copies of this Notice are attached for inclusion in the public record in the above-captioned proceedings. Should you have any questions regarding this matter, please contact me.

Sincerely,

Donna N. Lampert

cc: Chairman William Kennard (w/encl.)
Commissioner Michael Powell (w/encl.)
Commissioner Gloria Tristani (w/encl.)
Commissioner Susan Ness (w/encl.)
Commissioner Harold Furchtgott-Roth (w/encl.)

AMERICA ONLINE
INCORPORATED

May 6, 1998

Chairman William Kennard
Federal Communications Commission
Room 814
1919 M Street, N.W.
Washington, D.C. 20554

Re: In the Matter of Universal Service - Report to Congress -- CC Docket No. 96-45

Dear Chairman Kennard:

America Online, Inc. (AOL) is pleased to submit the attached study authored by University of Michigan Professor Jeffrey MacKie-Mason, "Quantifying the Contribution: Estimates of Telecommunications Services Expenditures Attributable to Online Service Production and Consumption." This study estimates that Internet and online service production and consumption has generated roughly between $10 billion and $28 billion dollars of incremental telecommunications services revenues between 1990 and 1997, with incremental revenue in 1998 alone likely to be approximately between $6 billion and $17 billion. Using the midpoint between the ranges, telecommunications service revenues attributable to online service production and consumption are roughly $11.4 billion for 1998 and $18.7 billion for 1990-1997. This additional telecommunications service revenue adds to the revenue base of telecommunications carriers, generating funds for universal service. We believe this study seeks to quantify for the first time the net contribution to the universal service funding base resulting from Internet and online services and will be of assistance as the Commission prepares its latest report to Congress on universal service issues.

Significantly, this revenue would not have existed but for the growth of Internet and online services. Rather than draining universal service funds and decreasing the revenue base to support this crucial policy goal (as some have argued), Internet and online services have actually helped contribute to and support universal service. As the FCC noted in its recent Report to Congress, universal service and the growth of new Internet-based information services are mutually reinforcing. Thus, as Internet-based services grow, so too do telecommunications service needs and their corresponding universal service contributions. In that context, it should be emphasized that AOL and other ISPs today already pay rates for telecommunications services that incorporate universal service contributions. AOL alone expects to spend over a billion dollars for telecommunications services in fiscal 1999.

Please be aware that the attached study addresses only current contributions of online and Internet services to universal service and does not attempt to make predictions about the future. AOL understands that difficult regulatory issues will inevitably arise during this time of transition to a fully competitive telecommunications marketplace with an explicit universal service subsidy system. To promote the continued preservation and advancement of universal service, we urge both the FCC and the Congress to keep a watchful eye on emerging issues and developments in this key area. We also ask you to bear in mind that just as television never replaced radio, cable did not replace broadcast television, and VCRs did not replace movie theaters, there is no genuine evidence that the growth of Internet services will undermine telecommunications and corresponding universal service goals. Rather, as the attached study demonstrates, the growth of Internet and online services has and will continue to ensure that the universal service goals of the 1996 Act are attained.

Finally, we wish to reiterate our firm commitment to the fundamental goal of universal service. Should you or your staff have any questions, or wish to discuss in greater detail the study or any of the issues raised, please feel free to contact me.

Sincerely,

George Vradenburg, III
Senior Vice President and General Counsel

Enclosure

cc: Commissioner Michael Powell (w/encl.)
Commissioner Gloria Tristani (w/encl.)
Commissioner Susan Ness (w/encl.)
Commissioner Harold Furchtgott-Roth (w/encl.)

Quantifying the Contribution:
Estimates of Telecommunications Services Expenditures Attributable to Online Service Production and Consumption

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and

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May 1998

Jeffrey K. MacKie-Mason

Complete curriculum vitae available at: http://www-personal.umich.edu/~jmm/

Jeffrey K. MacKie-Mason is an Associate Professor of Economics and Information at the University of Michigan. He holds a tenured position in the Department of Economics, and a tenured position in the School of Information. He is also a Research Associate at the National Bureau of Economic Research in Cambridge, Massachusetts. He received his Ph.D. in Economics from the Massachusetts Institute of Technology (1986). Professor MacKie-Mason has published papers in the economics of information technology and content, telecommunications, industrial organization, public finance and finance. He is the founding Director of the Program for Research on the Information Economy (PRIE) at the University of Michigan.

Recent funded projects include: "Market-Based Adaptive Architectures for Information Survivability" (with Michael Wellman and Sugih Jamin, DARPA, 1997-2000); "Pricing Electronic Scholarly Information" (Council on Library Resources, 1997-1999); and "The Economics of the Internet" (with Hal Varian; NSF, 1994-1997).

Professor MacKie-Mason serves on the editorial boards of the *RAND Journal of Economics*, *Netnomics:Economic Research and Electronic Networking*, and *Telecommunications Systems*. His teaching includes information and network economics and policy. He was the Chair of the Program Committee of the 25th Annual Telecommunications Policy Research Conference (1997); co-Program Chair of the First International Conference on Information and Computational Economies (1998). He is a Cable Communications Commissioner in the City of Ann Arbor, Michigan.

Professor MacKie-Mason has consulted for many computing and telecommunications companies. His clients have included America Online; GTE, Bell Atlantic; Sun Microsystems; AT&T; and EDS.

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Prof. Jeffrey K. MacKie-Mason

"My key fact of the week is that there is no meaningful notion of an 'average' ISP."[1]

I. INTRODUCTION

I am Jeffrey K. MacKie-Mason, Associate Professor of Economics and Information at the University of Michigan. I have been asked by America Online, Inc., to estimate the telecommunications services revenues that have been generated as a result of demand for online services. The opinions expressed herein are solely my own.

In my previous comments on this matter,[2] I argued that Universal Service Fund (USF) contributions should be assessed on telecommunications carriage service revenues. This will foster the development of the widest possible range of services that use telecommunications carriage as an input. By taxing telecommunications carriage, rather than the information services that make use of telecommunications carriage services, the FCC ensures competitive neutrality among various information services offerings. More importantly, such a policy will encourage the sort of vibrant interplay of market forces that has led to the phenomenal success and innovation of the Internet and online services.

In the present comment I focus on the narrower task of trying to quantify how online services have impacted Universal Service Fund contributions. What will be seen is that all telecommunications components of every Internet Service Provider (ISP) service have contributed to USF. From this analysis, I conclude that over the period 1990-1997, online service production and consumption has generated between roughly $10 billion and $28 billion of incremental telecommunications services revenues, with incremental 1998 alone revenue between $6 billion and $17 billion. Using the mid-point between these ranges, telecommunications services revenue attributable to online service production and consumption are roughly $11.4 billion for 1998 expenditures and $18.7 billion for 1990-1997 expenditures. USF contributions are paid on all of these revenues.

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[1] Metcalfe, Bob. "ISPs add stripes, dots to differentiate themselves in a Darwinian market," *InfoWorld*, January 13, 1997, quoted in Leida, Brett , "A Cost Model Of Internet Service Providers: Implications For Internet Telephony And Yield Management," MIT Department of Electrical Engineering and Computer Science, 1 November 1997.

[2] MacKie-Mason, Jeffrey K., "Layering for Equity and Efficiency: A Principled Approach to Universal Service Policy." Comments submitted to the FCC re: Report to Congress on Universal Service Funding, CC Docket No. 96-45, 6 February 1998.

The main points are these:

- There has been an explosion in demand for online services;
- These services are generally delivered via basic telecommunications carriage infrastructure;
- To date, online services have displaced a negligible amount of traditional telecommunications service.
- Therefore, the growth in consumption of online services has led to increased consumption of basic telecommunications carriage services.

Moreover, even if some displacement occurs in the future, the rapidly growing demand for telecommunications services to support most online information services will outweigh displacement, with a net increase in telecommunications services subject to USF contributions.

My task is to analyze how production and consumption of online services use telecommunications carriage as an input. That analysis yields expectations about how the demand for various types of basic telecommunications services should have changed as a result of the growth in online service consumption. It therefore allows us to focus on those areas most likely to have been affected, guiding our search for quantifiable data.

I proceed by describing the physical and financial aspect of the telecommunications services input component of ISP services. I then look at the current and future impact of ISP services on USF funding.

II. EXECUTIVE SUMMARY

Online access is a dynamic, rapidly growing industry; telecommunications services are but one of the inputs used in producing online services. Estimating the amount of telecommunications services expenditures that are attributable to the production and consumption of online services is inherently difficult: many types of accurate, market-wide data are unavailable and available data are quickly obsolete.

It is important to recognize that the numbers presented below represent additional telecommunications services revenue that would not have existed but for the growth of online services. Thus, online services can be said to have contributed very significant incremental revenue to telecommunications services providers to date.

I demonstrate that a significant share of the recent growth in residential 2nd lines is attributable to demand for online services, generating substantial, incremental telecommunications services revenue. I develop a simple model to estimate business and ISP purchases of telecommunications services, and find again that substantial, incremental telecommunications services revenues were generated. I also show that the telecommunications services revenues that are attributable to production and consumption of online services have been incremental to traditional PSTN revenues rather than displacing them.

I look at online services' impact on telecommunications services expenditures by looking separately at residential, business, and ISP purchases of those telecommunications services. The following table contains estimates of the revenue flow ~~in~~ 1998, extrapolated to annual amounts, as well as a cumulative total for the years 1990-1997.

	Conservative	Upper Bound
Metered Primary Lines	*	*
Residential 2nd lines	$2,520	$4,789
Business users	$1,498	$8,666
ISP local connections	$643	$1,100
ISP National backbone	$1,255	$2,332
ISP International backbone	*	*
1998 Totals	$5,916	$16,887
Cumulative total (1990-1997), all categories	$9,702	$27,694

(all figures in millions)

The conservative estimate is the amount I think could reasonably be attributed to online service usage, being conservative in my estimate: I expect the actual expenditures are likely higher than this estimate.

I have attempted to be quite conservative in my estimates. In several areas I have not found sufficient information to make informed estimates and have chosen to leave these areas out of my calculations. Thus, my "upper bound" estimate is only for those revenue categories in which I have been able to develop estimates. If, for example, residential expenditures on metered primary lines or ISP purchases of international telecommunications carriage services are significant, the <u>total</u> telecommunications services revenue derived from online services could exceed my "upper bound" estimate.

Similarly, not including estimates for revenues from metering of residential primary lines and international backbone purchases necessarily increases the conservatism of my "conservative" estimate. Additionally, my "conservative" calculation leaves out other revenue categories, each of which is certainly positive: "churn" installation revenue on residential 2nd lines and the installation and base charges on dial-up business lines acquired specifically for online access are examples.

While the range in the figures is considerable, it is clear that online services have generated significant growth in the consumption of telecommunications services.

* These amounts are certainly positive and possibly significant. However, I have not found sufficient information to allow me to estimate their magnitudes. Thus, the totals presented <u>understate</u> the actual telecommunications services revenues that are attributable to online services.

III. EXPENDITURES ON TELECOMMUNICATIONS SERVICES IN THE PRODUCTION AND CONSUMPTION OF ONLINE SERVICES

To examine USF charges in the context of ISP services, we must understand the telecommunications facilities involved in those services. This is most easily done by separately examining ISPs and their different customer types. I proceed by describing how the two categories of ISP customers, residential and business, connect to their ISPs. I then address how ISPs transmit services among themselves.[3] In each instance, I describe the "physical" differences — the different telecommunications services used by ISPs and their customers. I then describe the "financial" differences — the effect of the "physical" structure on the telecommunications services expenditure of the ISPs and their customers. I conclude each section by presenting estimates of the incremental telecommunications services revenue directly attributable to consumption of ISP services.

Lastly I examine some specific services offered by ISPs.

A. Estimate of Residential Customers' Expenditures on Telecommunications Services That are Due to Their Consumption of Online Services

1. Physical Structure

Most ISP customers are residential users.[4] Essentially all residential users connect to their ISPs via dial-up connections over the public switched telephone network (PSTN).[5] The user can connect over one of three dial-up line types: primary line, 2nd line, or ISDN. A primary line connection is used by a customer having only one telephone line to his house. A customer who has a second line might connect to her ISP over either line; for simplicity I refer to a line

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[3] That is, when examining end users, I treat their ISPs as black boxes containing the entire online spectrum. I examine the contents of the black boxes when looking at inter-ISP traffic.

[4] For example:

- 70% of online users access from home. IntelliQuest, "IntelliQuest Survey Results," http://www.intelliquest.com/, 5 February 1998.
- 66% of online users access from home. IntelliQuest, "IntelliQuest Survey Results," Press Release, 18 November 1997.
- 63% of Internet users purchase their own access; FIND/SVP, "The 1997 American Internet User Survey," Press Release, 6 May 1997.
- About 80% of ISP subscribers in Pacific Bell's service area were residential. Pacific Telesis, "Surfing the 'Second Wave'," Pacific Telesis 'White Paper', 1 June 1997, Part III at p. 5.

[5] Other means of access, such as xDSL and cable modems, are only now being implemented. For example,

- Ameritech currently offers xDSL (ADSL specifically) in Ann Arbor MI. Ameritech, "ADSL Questions and Answers," http://www.ameritech.com/products/data/adsl/, 25 March 1998.
- US West has started offering a version of xDSL, with availability in 40 cities planned by the end of June 1998. See "MegaBit Services Availability," at US West's web site, 30 March 98, http://www.uswest.com/com/customers/interprise/dsl/availability.html.

acquired for accessing online services as a "2nd line".[6] A customer with an ISDN line has a wide range of choices in how the line is configured.[7]

All three residential connection types have a common feature: the consumer's direct physical connection is to his local exchange company (LEC), not to his ISP. Furthermore, that connection is acquired from her LEC, not from her ISP.

The ISP, in turn, has a connection to the LEC.[8] I describe the connection between the LEC and the ISP when I discuss inter-ISP activity.

These connections are depicted in FIG. 1, RESIDENTIAL USERS, APPENDIX..

2. Financial Structure

In this section I discuss only the residential side of the telecommunications links between a residential consumer of ISP services and her LEC. I ignore both the connection from the LEC to the ISP and the additional telecommunications links that may be utilized by various activities the consumer engages in once connected to his ISP. These are addressed in my discussion of inter-ISP connections.

Almost all residential connections are via the end user's LEC and are acquired from that LEC. Charges for these connections, as LEC end user revenues, have incurred USF obligations.[9]

a) Primary Line Connections

All residential primary line connections result in USF contributions. What has been generally, and erroneously, assumed is that connections to ISPs over residential primary lines result in no incremental USF contributions. Whether connecting to an ISP over a primary line results in

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[6] That is, if a consumer has two lines and uses only one to access online services, the "non-online" line is irrelevant for our purposes here - it was and is purchased solely for POTS and no USF contributions from it are attributable to online services. Some of the "online" 2nd lines were acquired for purposes other than accessing online services and would continue to be purchased if online services did not exist. For our purposes, the analysis of these lines is identical to the analysis of residential primary lines used for online access: only metered-usage charges resulting from online service consumption can be attributed to online services; the "base" charges should not be attributed to online services. Therefore, when I refer to "primary" lines, I am referring to any line acquired for reasons other than accessing online services that is also used to access online services. When I refer to "Residential 2nd lines" or "dedicated 2nd lines", I am discussing residential lines acquired specifically for accessing online services. I ignore some "special cases" where multiple residential lines are each used for POTS and online access (e.g. college students sharing an apartment, each having his own telephone line that is used for both voice and online access).

[7] That is, the line might be configured as two 64kbps data pipes or one data pipe and one voice pipe or any of a number of alternative configurations. Bellcore has developed 22 "standard" configurations for ISDN service: see http://www.ameritech.com/products/data/teamdata/pricing/2010iocd.html for descriptions.

[8] This connection is also typically acquired from the LEC (an incumbent LEC ("ILEC") or a competitive LEC ("CLEC")), although it might be acquired from an interexchange carrier ("IXC").

[9] See Federal State Joint Board on Universal Service, Report and Order, CC Docket No. 96-45, 12 FCC Rcd 8776, at 9199-9201, 9206, 9211 (May 8, 1997).

incremental USF contributions depends on whether that line has some sort of usage-based metering.[10]

Some states require flat rate pricing for local access service.[11] In these areas, a connection to an ISP over a primary residential line will not generate incremental USF contributions. However, in these states, connecting to Mom for her "recipe advice service" also incurs no incremental USF contributions, nor do any of numerous other services one may consume via local telephone lines.[12] It also bears keeping in mind that these primary lines have paid USF contributions; they are not "free riding" on others' contributions. Rather, I am merely indicating that USF contributions on flat rate primary residential local access lines should not be attributed to demand for online services.

Many states have allowed various methods for metering local telecommunications service usage. Some use messaging rates: charges are per-call.[13] Others use measured rates: charges are per

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[10] Usage-based metering in this context refers to plans wherein the price of basic local telephone access service varies with some metric of the quantity of basic local telephone service consumed; calls and minutes of calling time are the two most common metrics. Thus, a flat rate plan is one where all consumers of a given type (e.g. residential or business) pay the same price for basic local telephone access, regardless of the quantity consumed.

Observers often erroneously refer to some usage-based metering plans as "flat rate" and erroneously conclude that all "flat rate" plans generate no incremental USF contribution. In fact, an increasing number of "flat rate" plans are not true flat rates: after a fixed number of call units (minutes or calls), the customer pays incrementally for additional calling. Thus, if use of the primary line for ISP service pushes the consumer above the threshold, those incremental calls will generate incremental USF contributions. For example, I have a residential line in Ann Arbor, MI with a 50-call limit per month before I incur per call charges. If I make a 51st call, I generate incremental revenue for my LEC.

There is another aspect of metered-usage plans that is relevant to our discussion: the "lumpiness" or granularity at which you can purchase additional quantities of service. In Ann Arbor, there are three levels of service available (in respect to the quantity of local access purchased): the 50-call service I have, a 400-call limit, and unlimited. Having chosen the 50-call plan, I pay a set fee for each call I make in excess of 50; that is, additional service is available in increments of 1 unit. However, I can instead choose to subscribe to the 400-call plan. If I do so, it does not mean there is no incremental cost in making my 51st call of the month. Rather, the 400-call plan involves purchasing a "lump" of 350 additional calls: all of the difference in price between the 400-call plan and the 50-call plan is incremental, usage-based revenue. Similarly, the unlimited calling plan means purchasing two incremental lumps - one of 350 calls and one with an unlimited number of calls.

An important point is that the unlimited-calls plan in Ann Arbor is not a flat rate plan! Rather, it is the most expensive, largest quantity offering among several metered usage plans available and as such, all of its price that is in excess of the basic, 50-call limit plan is incremental, usage-based revenue to the LEC.

Throughout this report, when I refer to flat rate pricing, I mean there is no metering of any sort, at any degree of "lumpiness," occurring. That is, under a true flat-rate, the only quantity decision that affects price is whether or not to subscribe. All other plans, including the "unlimited calling" option available in Ann Arbor, involve incremental charges based on some metric of incremental calling. This means that online usage generates incremental residential basic access revenue in all regions where carriers offer tariffs other than (true) flat rate.

[11] Indiana, for example.

[12] See MacKie-Mason (1998) at 5 for a list of examples.

[13] In some states (e.g., Michigan), the consumer chooses among bundles of calls: 50 per month, 400 per month, unlimited; the limited bundles include additional per-call charges for each call above the bundle limit.

minute.[14] Some states allow a combination of both types, possibly including adjustments for distance between caller and recipient.[15]

Under metering tariff regimes, accessing ISP services via a residential primary line frequently generates incremental telecommunications revenues with resulting incremental USF contributions. For example, a graduate student assistant of mine signed up for a 50-call per month message rate when he arrived in Ann Arbor. After he began working with me he found he was needing to check his e-mail several times each day; by the middle of the month he would reach his 50 call limit and thereafter incur per-call charges. Those charges were incremental revenue for Ameritech, resulting in incremental USF contributions. The incremental revenue and contribution were directly attributable to online service consumption. Eventually it became more economical for him to switch to a 400-call per month plan. Again, the revenue difference between the 50-call and 400-call plans was incremental revenue for the LEC that was directly attributable to online service consumption. (He explained this higher spending on LEC telecommunications services to me while asking for a raise.)

In areas where the metering is less lumpy, the relationship between incremental online service usage and the amount of USF contribution will be more direct. If each minute or each call to an ISP results in incremental LEC revenue, it results in incremental USF contributions that are directly attributable to online service usage.

I have not attempted to quantify the incremental metered primary line revenue due to online usage. I expect this revenue, coming either from customers switching to a higher-quantity service plan or from direct per-unit metering, could be significant.[16]

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[14] For example, Pacific Bell offers a measured rate service that includes a per-month allowance with per-minute charges for minutes in excess of the allowance. Pacific Bell, "Discount Calling Plans," at http://www.pacbell.com/products/residential/basic/dialtone/, March 1998.

[15] For example, Ameritech recently introduced a local calling plan in Illinois that charges $0.05 per call for calls to locations up to 8 miles from the caller; calling beyond the 8 mile limit is billed at $0.05 per minute. Ameritech, "Ameritech introduces 'Simpli-Five' new calling plan for Illinois customers," News Release, 16 February 1998.

[16] *As I demonstrate in the following section (Residential 2nd line connections), it is likely that roughly ½ of* residential online service subscribers access online services using residential 2nd lines that were acquired specifically for online access. The other ½ of residential online service users access either via their primary lines or via second lines acquired for some other reason. The size of incremental, metering revenue attributable to online use will depend on how many of these users have either shifted to higher-usage local calling plans or incurred direct metering charges.

The incremental expenditures for an individual who switches to higher usage plans can be quite large: for example, Pacific Bell charges $11.25 per month for its unlimited-local-calling plan, while its base plan, a measured service plan with per-minute charges for usage beyond the allowance, is $6.00 per month. (Pacific Bell, "Discount Calling Plans," http://www.pacbell.com/products/residential/basic/dialtone/, 1 March 1998.) The FCC reports average national prices for "unlimited" local calling plans and "lowest generally available rates." The rate difference between the plans has been fairly stable at $6.50 - $7.00 for over a decade. If the FCC and/or the states has (unpublished) data over the same time period reflecting the relative frequency with which customers have chosen the various local calling plans, it should be possible to ascertain what impact online usage has had on consumers' choices of calling plan and quantify the incremental revenue that has resulted from online usage driving consumers to higher-quantity usage plans.

b) Residential 2nd Line Connections

In the past decade there has been a surge in 2nd telephone lines for residential usage.[17] Residential 2nd lines generated $17.8 billion in revenue for LECs between 1988 and 1997 and likely will generate $5.5 billion in LEC revenue in 1998, with corresponding growth in the USF contribution base.[18]

LECs have attributed some of the demand for 2nd lines to demand for online services.[19] My assistant is an example of this: he recently complemented the 400-call plan I described above by acquiring a 2nd line (followed by another request for a raise).

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[17] The FCC estimates that only 2.7% of households with telephone service had 2nd lines in 1988. By 1996, 16.5% of households with telephone service had 2nd lines. FCC, *Trends in Telephone Service*, Industry Analysis Division, February 1998 [hereafter: *Trends* 98], Table 18.3. See also Chart 1, NUMBER OF LOCAL LINES BY TYPE and Chart 2, GROWTH IN LOCAL LINES BY TYPE. (Sources at fn. 24)

[18] The $17.8 billion estimate is the (not inflation adjusted, not present/future value corrected) sum over 1988-1997 of:

the net number of residential lines installed each year * average minimum installation charge

+ the average number of residential 2nd lines in use each year * average monthly charges *12

The 1998 estimate is calculated in the same manner.

Net number of residential 2nd lines installed is the simple difference between number reported for current year minus number reported in preceding year.

Average residential 2nd lines in use each year is calculated as prior year number in use + ½ of current year installed lines.

Data for 1988-1996 is taken from *Trends* 98, Tables 14-1 and 18-3.

Data on number of 2nd lines, average installation charges and line charges are not currently available for 1997 or 1998. The number of 1997 residential 2nd lines was estimated by applying the 1988-1996 compound annual growth rate ("CAGR", it was 26.8% over this period) to the 1996 number of lines. This yields an estimate of 19.9 million residential 2nd lines at year-end 1997. Applying the 1988-1996 CAGR to the 1997 estimate gives a year-end 1998 estimate of 25.3 million residential 2nd lines. Using the 1988-1996 CAGR probably underestimates the actual 1997 and 1998 increases in residential 2nd lines: see fn. 19 for comments from several RBOCs on the recent increase in demand for residential 2nd lines.

I used the 1996 data for 1997/1998 base and installation charges. I used 1996 data for 1997 SLC/PICC charges, but used the new residential 2nd line amounts for 1998 ($5.00 for SLC, $1.50 for PICC). [FCC, "The FCC's Interstate Access Charge System," CCB-FS012, 1 February 1998. The FCC states that the $1.50 SLC surcharge is a cap on, rather than a specific amount for, the SLC surcharge. However, the current SLC, also a "cap", has averaged very close to the cap amount. *Trends* 98, Table 14.1. Additionally, the non-primary residential PICC can increase by $1 each year, adjusted by inflation in the future. CCB-FS012. Lastly, note that the SLC cap can rise by $1 per year, up to a maximum of $9.00 for the SLC (FCC 97-23, "Commission Reforms Interstate Access Charge System," FCC News, 7 May 1997).]

The calculations are based on <u>net</u> 2nd line installations each year and therefore conservatively understate total installation revenue each year. Installation revenue depends on <u>gross</u> 2nd line installations each year, which equals net installations + removals:

1996 end of year 2nd lines = 1995 end of year 2nd lines + gross 1996 installations - 1996 removals

[19] For example:

- According to Dave Dorman of Pacific Telesis, "In every [Pacific Bell] product category touched by the Internet, we find runaway demand," citing the following increases in demand:
  "New phone lines -- 150%

There is additional evidence indicating demand for online services has contributed substantially to demand for 2nd lines. From 1980-1990, local-call dial-equipment-minutes (DEM) increased steadily each year, rising on average 2.4% annually. Beginning in the early 1990s, local-call DEM began increasing more rapidly, rising on average 4.5% annually from 1991 to 1996.[20]

Beginning in the early 1990s, demand for online services began to grow.[21] The timing and size of this demand coincides with the growth in demand for local calling. If we add the minutes of local calling used for online services to the projected consumption based on the historical growth in local calling, we see they match the actual consumption of local calling very well.[22] This strongly suggests that demand for online services has caused much of the increased demand for local calling.

Despite the significant increase in local DEM attributable to the use of online services, local calling minutes per local loop have been essentially constant.[23] That means at the same time demand for local calling minutes increased, there must have been a parallel increase in demand for local telephone lines. The data show residential 2nd lines growing dramatically faster than either primary residential lines or business lines.[24]

Second phone lines -- 190%
ISDN -- ... -- 285%
Business data services of various kinds – 321%; 260%; 181%; 215%; and 170% (depending on the type of data service.)"

Dorman, Dave, "Telecom Deregulation and Internet: Remarks at the Association for Corporate Growth, Los Angeles," http://www.pactel.com/about/mgnt_perspectives/dorm11597.html, 15 January 1997.

- "At Bell Atlantic, virtually all the growth in our residential telecom business is vertical growth, driven by the residential consumer's explosive demand for data and advanced services: 15 percent growth in 2nd lines, most of which are used as Internet hook-ups; 35 percent growth in ISDN, the only widely available mass-market digital service in the market today;..." Seidenberg, Ivan G., "Brave New World," Speech at ComNet '98, 28 January 1998.
- Ameritech 10-Q filing 30 September 1997 credited access line growth to demand for Internet access and data transport.

[20] See Chart 3, LOCAL CALLING DEM. The bars on Chart 3 show local DEM per year. The line labeled "Trend 1980-1990" projects what local-call DEM would have been in later years *ceteris paribus*: if demand for local calling had been stable. The line labeled "Trend 1991-1996" shows that local calling in the 1990s has been growing at a significantly higher rate than it was in the 1980s.

Actual local calling minutes are from *Trends* 98, Table 12.1

The trend lines are OLS regressions of "local calling minutes" on "year" for the years specified.

[21] See Chart 4, ONLINE SERVICE CONSUMPTION. Data from *Statistical Abstract of the United States* 1997, Table 887 (Online service hours per adult over 18) and Table 14 (US population minus US population aged 0-17).

[22] See Chart 5, TOTAL LOCAL CALLING DEM DECOMPOSITION. (Sources as for Chart 3 and Chart 4.)

[23] See Chart 6, LOCAL CALL MINUTES PER DAY. Data from *Trends* 98, Table 12.2.

[24] See Chart 1, NUMBER OF LOCAL LINES BY TYPE. This shows that in absolute numbers, residential 2nd lines are being installed faster than any other type. Data from *Trends* 98, Table 18.3 (Non-residential and 2nd lines), Table 15.1 (Household primary lines). Table 18.3 begins in 1988.

See also Chart 2, GROWTH IN LOCAL LINES BY TYPE, showing much higher growth rate for residential 2nd lines than for other line types. Same data sources.

This indicates that the "new" growth in local calling minutes observed in the 1990s has been offset by the surge in demand for residential 2nd lines that also has occurred in the 1990s. That in turn supports the proposition that a significant share of the increase in residential 2nd lines results from online service users acquiring 2nd lines dedicated to online access.[25]

I estimate that in 1997, between 8.5 million and 10.8 million 2nd lines were dedicated to online usage.[26] That figure is well within the (estimated) number of residential 2nd lines.[27] For 1998, I

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[25] It is likely some purchasers of 2nd lines are motivated by needs other than or in addition to online usage. Fax machines and teenagers come to mind. However, while the "arrival" and then departure of teenagers undoubtedly affects individual households, a teenager arriving in one household is generally offset by one leaving another household. Teenagers seem to have no discernible effect on total calling minutes: regressing "total local minutes" on "year", "online usage", and "population aged 14-17" indicates the teenager effect is not statistically different from zero.

[26] By "dedicated to online usage", I mean the lines were acquired for online access and that, even if other functions (fax, voice telephony) occur using these lines, the lines would not be acquired or kept without demand for online services. Thus, if a consumer had a residential 2nd line she used for her fax machine and later began using this line also for accessing online services, her incremental expenditures due to online usage (assuming a metered line) are not included in the estimates of this section. Rather, they would be included in the estimates of the preceding section on Residential Primary line expenditures. See fn. 6.

[27] See Chart 7, RESIDENTIAL 2ND LINES IN USE and table below.

Residential 2nd line count from *Trends* 98, Table 18.3

The number of residential 2nd lines attributable to online usage is calculated as total residential online minutes divided by the average local calling minutes per day per local loop (average over 1980-1996, ~38.5 minutes). The derivation of this calculation is as follows:

Let

x = lines not used for online access (non-subscribers' lines & 2nd-line-subscribers' primary lines)

y = online subscriber via primary line

z = online subscribers via 2nd lines (2nd-line-subscribers)

c = the (constant) average local call minutes per local loop

o (online) = the average online connect time per online subscriber, assume same for primary line & 2nd line subscribers

We know that the average local call minutes per local loop per day have not changed, despite the growth in total local connect minutes due to online service use. Thus, we can safely assume that non-online-access lines (x) are used at the average rate (c). Lines used only for online access (z) are used at the average online connect time rate (o). Lines used for both local calling and online access (y) are used at the sum the local call rate plus the online access rate ($c + o$) [we know online use did not displace "calling" use because, as just demonstrated in the text, total local calling time has increased by somewhat more than online service usage time].

expect the number of residential 2nd lines dedicated to online access to grow to between 11.3 million and 14.4 million. The higher 1998 estimate requires roughly one half of residential online service subscribers to have a 2nd line dedicated to online use.[28]

To the extent a consumer's decision to acquire a 2nd residential line is driven by her use of online services, both the installation and recurring charges are incremental telecommunications revenues attributable to online usage. Thus, consumers connecting to their ISPs via 2nd residential lines cause incremental USF contributions whether their local access is metered or flat rate.[29]

I conservatively estimate the cumulative residential 2nd line revenue attributable to online service consumption between 1990 and 1997 exceeds $4.1 billion and the 1998 revenue will exceed $2.5

$$
\begin{aligned}
c &= \frac{xc + y(c+o) + zo}{x+y+z} \\
&= \frac{(x+y)c + (y+z)o}{x+y+z} \\
&= \frac{(x+y)c + \text{total online time}}{x+y+z} \\
&\Rightarrow \text{total online time} = zc \\
&\Rightarrow z = \frac{\text{total online time}}{c}
\end{aligned}
$$

Minimum implied residential 2nd lines assumes residential user minutes are 63% of all online minutes (see fn. 4 for 63% source, fn. 21 for total online minutes sources).

Possible implied residential 2nd lines is calculated in the same manner, but assumes residential user minutes are 80% of all online minutes (see fn. 4 for 80% source).

The lower estimate in the text is "minimum implied..."; the higher estimate is "possible implied..."

The estimated number of residential 2nd lines dedicated to online use in each year is:

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Min. lines	0.5	0.5	1.0	1.0	1.6	3.7	5.8	8.5	11.3
Poss. lines	0.6	0.6	1.3	1.3	2.0	4.7	7.4	10.8	14.4

(all numbers in millions)

[28] FIND/SVP expects 28 million online households for 1998. FIND/SVP, "U.S Internet Household Forecast," 1998. Note that this is not saying that ½ of online service customers access via a 2nd line; rather, it suggests that ½ or less of online service customers acquired 2nd lines specifically for online service access. As discussed earlier (see fn. 6, 25 and 26), some customers who access via "2nd lines" acquired and maintain their non-primary lines for reasons other than online access and are therefore treated herein as if they access online services via a primary line.

[29] Because I have used national average local per-line charges, the relative prevalence of flat-rate and various metering methods for local access lines is reflected in my estimates.

billion.[30] An upper bound estimate of 1998 residential 2nd line revenues attributable to online service usage is $4.8 billion.[31] These estimates are in the range of other observers' estimates.[32]

c) Residential ISDN Connections

Demand for residential ISDN connections derives directly from demand for online services.[33] Thus, at the very least, all residential ISDN revenue in excess of the revenue that would result

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[30] These estimates come from applying the methodology and prices described in fn. 18 to the estimated minimum number of residential 2nd lines attributable to online usage described in fn. 27. The increases in SLC and PICC on residential 2nd lines over the coming years, with the per-month caps rising by $1 each year (FCC 97-23, "Commission Reforms Interstate Access Charge System," FCC News, 7 May 1997), will also increase the amount revenue online users contribute to the USF base.

[31] Because this is intended as an upper bound, I have used what I believe are some rather high estimates from other sources. The calculation is:

18,666,667 residential 2nd lines attributable to online usage
x $20.24 per month, historical base charge + $5.00 SLC + $1.50 PICC
x 12 months
$ 4.5 billion

Note that my "conservative" estimates used only net 2nd line installation revenue, ignoring "churn" installations. ETI estimated that 1/3 of residential 2nd lines dedicated to online use were "churned" each year (see fn. 32 for cite); with an assumed base of 18 2/3 million "online" 2nd lines, that gives churn revenue of

6,216,000 churn lines
x $41.08 per install
$ 0.26 billion "churn installation" revenue

The estimate of 18 2/3 million residential 2nd lines attributable to online usage comes from using an estimate of 28 million online households (FIND/SVP, "U.S Internet Household Forecast," 1998) with 2/3 of them having 2nd lines dedicated to online access (Richard Cawley of the European Commission's DG XIII reports that "about two-thirds" of US residential Internet users have 2nd lines for Internet access. Cawley, Richard A, "Internet, lies, and telephony," Telecommunications Policy, 21(6): 513-532, 1997 at 519.)

[32] For example:

- MMTA/TIA report "growth of the Internet has spurred demand for access lines, contributing an estimated $2 billion in incremental revenues to the LECs." They do not report methodology nor whether that figure is annual or cumulative. MultiMedia Telecommunications Association, *1998 MultiMedia Telecommunications Market Review and Forecast*, 1998, (hereafter *MMTA* 98) at 37.
- ETI estimated the incremental revenue attributable to residential 2nd lines from 1990-1995 at $3.65 billion, with 1995 revenue at $1.4 billion. Selwyn, Lee L. and Joseph Laszlo, "The Effect of Internet Use on the Nation's Telephone Network," Economics & Technology, Inc., 22 January 1997. For comparison, I calculate 1990-1995 revenue at $1.45 billion to $1.85 billion with only $620 million to $790 million in 1995 incremental revenue. There are several fundamental differences in approach underlying the disparity in our estimates. One is that I ignored "churn" installation revenue, which Selwyn and Laszlo estimate as 1/3 of installed lines each year.

[33] ISDN is "a digital connection, used mainly by serious Internet types," Dave Dorman, of Pacific Telesis, "Telecom Deregulation and Internet: Remarks at the Association for Corporate Growth, Los Angeles," 15 January 1997. http://www.pactel.com/about/mgnt_perspectives/dorm11597.html [accessed on 1/30/98; web site is currently undergoing complete redesign as of 3/30/98].

Unlike business ISDN subscribers, households rarely use any of the non-data service possible with ISDN (see § II.B.2 **[fill in]** for business uses of ISDN). I have had a residential ISDN connection for data communications over 4 years. In the course of writing this report, I was surprised to learn this likely means I was among the first 500 ISDN subscribers in the United States: there were 82 digital residential lines in 1993, only 515 in 1994. FCC, from supplying a like number of 2nd residential lines is incremental telecommunications services revenue attributable to online service consumption.[34]

Much like other local connections, ISDN price structures vary from state to state. They range from flat rate to the various types of metering. My comments about attributing 2nd line charges are equally applicable here although in the case of ISDN, we generally do not need to consider whether the ISDN purchase derives from demand for services other than online offerings.

The FCC reports there were only 64,847 residential digital access lines in use in 1996.[35] As a rough estimate, these lines generated between $10 and $20 million of incremental USF-obligated revenues derived from online service demand over the period 1993-1996, with ongoing annual incremental revenues attributable to online service demand of $7 million to $14 million.[36]

B. Estimate of Business Customers' Expenditures on Telecommunications Services That Are Due to Their Consumption of Online Services

1. Physical Structure

All of the telecommunications services options used by residential consumers of online services are also used by business consumers of online services. Because of their greater demand for telecommunications services, business consumers have available the additional option of leased line connections.[37] With a leased line, a business can connect directly (point-to-point) to its ISP or connect to its LEC, thence to its ISP.[38]

[See FIG. 2, BUSINESS USERS]

Statistics of Communications Common Carriers, 1994-1997 editions, 5 December 1997, (hereafter *SOCCC*), Table 2.5.

[34] I expect it would be more accurate to attribute the entire difference between single-line access and ISDN charges to demand for online services. A residential consumer who subscribes to ISDN service instead of merely acquiring a 2nd voice line reveals himself to be a very heavy data user rather than a very heavy voice services user.

[35] *SOCCC* 96, Table 2.5. Specifically, these are listed as "Residential digital" access lines. To the best of my knowledge, in 1996, ISDN was the only residential digital access line available.

[36] The smaller figures come from calculating the increment between Ameritech's residential ISDN pricing and national average charges for 2 residential lines. The larger figures compare Ameritech's residential ISDN rates with a single standard residential line. I used Ameritech's ISDN rates for Indiana because they are flat-rate, greatly simplifying the estimation.

Ameritech pricing: "General ISDN Rate Information," http://www.ameritech.com/products/data/, March 1998. Ameritech was chosen because it had detailed, readily available (online) pricing information.

Basic service residential line average pricing: *Trends* 98, Table 14.1.

[37] A residential customer could get a T1 connection to her house, but the price is prohibitive for most residential consumers.

[38] Generally, the connection will be a logical point-to-point line, rather than a physical line actually strung between the business and ISP. The actual, physical design is not important to my analysis.

2. Financial Structure

The USF implications of the various types of dial-up connections are broadly similar to the effects of the equivalent residential service. The charges for business lines generally parallel those for residential lines, with several differences. First, business access lines are traditionally more likely to have usage-based metering.[39] Second, business rates are generally somewhat higher than residential rates for the same telecommunications services.[40]

Unlike residential ISDN use, business use of ISDN is not necessarily attributable to demand for online services. ISDN also supports telecommunications services such as call centers and '800' lines among others. Thus, while some ISDN revenue in excess of (e.g.) multi-line analog business charges is undoubtedly attributable to demand for online services, we cannot conclude that all of it is as we did with residential ISDN.

Businesses' leased-line connections, whether directly to their ISP or to their LEC, are acquired from telecommunications carriers.[41] The revenue from the leases therefore generates incremental USF obligations attributable wholly, in the case of direct connections between businesses and ISPs, or partially, in the case of leased line connections to LECs where the line carries some online data traffic, to online service consumption.

Every leased line carrying some amount of online traffic causes incremental USF contributions attributable to online services. This is true whether the lease is flat-rate or includes usage charges. A flat-rate lease means incremental usage charges are "lumpy": they occur when the user's demand outgrows her current bandwidth and she leases additional capacity. On the other hand, a lease with usage charges will have a relatively smooth increase in incremental revenue as the user's traffic volume grows.[42]

There is considerable evidence that business' demand for online services has increased their demand for telecommunications services. Local private (leased) line revenues grew 54% from 1992-1996.[43] In recent years there has been a dramatic shift away from analog single-line

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[39] For instance, Pacific Bell notes that they earn usage revenue on local calls made by business. Pacific Telesis, "Surfing the 'Second Wave'," Pacific Telesis 'White Paper', 1 June 1997, Part III at p. 5

[40] I understand that business charges were traditionally set higher in part to support lower residential rates: that is, to support universal service goals.

[41] For purposes of discussion, I assume the customer, rather than the ISP, procures the direct leased line connection to the ISP. I understand this is generally the case. While it is likely there are some instances of the ISP procuring the leased line, the distinction is not important for my purposes: either way the lease payment is to a telecommunications carrier and the revenue from the lease generates incremental USF base.

[42] As technology has advanced, telecommunications carriers have been able to reduce the degree of lumpiness. For example, fractional T1 services are now available. Furthermore, it is erroneous to say that incremental usage that does not exceed a customer's present bandwidth is "free": rather the customer is now consuming that which he was previously paying for but throwing away. This is not to say the customer was forced against her will to purchase more capacity than she desired - many customers purchase spare bandwidth for various reasons. In this sense, the growing availability of fractional, easily upgraded bandwidth is a boon to consumers.

[43] FCC, "1996 Telecommunications Industry Revenue: TRS Fund Worksheet Data," Fig 1, 17 November 1997. I have not ascertained whether this figure includes intraLATA private line revenues. I suspect essentially all business-to-ISP private lines are intraLATA.

business access into analog multi-line business access: between 1993 and 1996, single-line service subscriptions declined 70% and multi-line subscriptions increased 100%.[44] Switching from single- to multi-line service is the business equivalent of a household adding a 2[nd] residential line.

I am not aware of any time series of data for business consumption of various telecommunications carriage services at the level of detail I need to track over time the growing impact of online services demand.[45] Additionally, the various factors that prevented me from estimating the incremental primary line use for residential online consumers are at work in the business market, magnified by the wider range of access options available to business combined with the wider variety of uses business makes of certain access technologies.[46] Hence, even single-year estimates of the incremental telecommunications revenue from businesses' use of online services are of necessity broad.

My calculations, described in the Appendix, suggest that in 1998 businesses will pay between \$1.5 billion and \$8.7 billion for telecommunications services used for online service consumption.[47] A rougher estimate of total past contributions would be in the between \$2.5 billion and \$14.2 billion.[48]

C. Estimate of ISP's Expenditures on Telecommunications Services

1. Physical Structure

Most ISPs have substantial telecommunications connections to several locations: analog or digital multi-line business access or leased lines to one or more LEC central office switches and leased lines to some high-volume business customers and other ISPs. The connections to other ISPs increases the value of an ISP's service to its own customers and assists other ISPs by

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[44] See Chart 8, BUSINESS ACCESS LINES BY TECHNOLOGY. *SOCCC* 93-97, Table 2.5 all years.

[45] A significant factor in this problem is the need for data extending several years prior to the growth of online service usage, as I had with the residential primary line data.

[46] For example, I could confidently attribute 100% of residential ISDN use to online service consumption. I am just as confident that less than 100% (but more than 0%) of business ISDN use is for online access.

[47] The variation in these figures derives from 2 sources: estimates of the number of business users and the method businesses use to obtain online connections. The former are derived from estimates of the total number of users and the share that is residential users, both of which vary widely. The latter involves assumptions about the relative number of users having dial-up access versus dedicated access and further assumptions about the amount of bandwidth each dedicated access user has. Thus, the lower estimate uses averages from several estimates of online users and residential users, and assumes two-thirds of business access is via leased lines with fairly conservative bandwidth assumptions (implying many users per dedicated access line). The upper bound uses a high estimate of total users, a low proportion of residential users, and assumes 100% of business access is via local dial-in.

See also fn. 58.

See Appendix for a description of the calculations for this and the ISP-to-LEC connection contribution.

[48] This is merely my estimates for 1998 times 1.64 - the approximate ratio of past to current obligations I observed from my conservative estimates of residential 2[nd] line revenues.

broadening the range of services those ISPs can offer to their customers.[49] The other types of connections listed are used to deliver the ISPs' services to their customers. Up to this point I have ignored the telecommunication connections between ISPs and LECs as well as the telecommunication connections among ISPs.[50]

Most ISPs deliver services to some of their customers via the public switched telephone network (PSTN). Anecdotal evidence suggests this has generally been done via analog multi-line business access to the LEC.[51]

However, there is a movement to digital types of access to the LEC: non-PBX/Centrex digital access capacity in use <u>sextupled</u> between 1993 and 1996.[52] This type of access is growing in popularity among ISPs.[53]

There are a variety of ways ISPs connect to each other. Most ISPs are small, local operations that connect directly to a single, larger ISP. The larger ISP connects to an even larger ISP, a "core backbone provider",[54] a network access point (NAP), or a combination of these. In this manner, essentially every ISP is able to offer to its customers access to every other ISP in the country (and in the world). The connections among ISPs are a combination of leased lines and ISP-owned lines.[55]

2. Financial Structure

I conservatively estimate ISPs' 1998 <u>local access</u> expenditures will exceed $640 million. My upper bound estimate for ISP local access expenditures is $1.1 billion.[56] Note that <u>all</u> ISP

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[49] Throughout this section, when I refer to connections "between ISPs" I am actually referring to any connection between two ISP POPs without regard to whether the two POPs belong to the same ISP or to different ISPs.

[50] The dedicated connection between an ISP and its high-volume business customer was discussed above in §III.B.

[51] 70% of Pacific Telesis' ISP connections were "1 MB" [the rate-structure name; a single line in a multi-line business rate] Pacific Telesis (1997) at Part III, p. 4. This connection is depicted in FIGS. 1 AND 2.

[52] The number (or capacity, reported as "equivalent number of 64kbps lines") of these went from 155-thousand in 1993 to 950-thousand in 1996. *SOCCC* 93-96, Table 2.4

[53] "[M]igrations [by ISPs] to PRI (primary rate ISDN) lines is growing." Pacific Telesis (1997), Part III at 4.

[54] "[Core Internet backbone providers] own and control their own networks; maintain nodes with default-free routers; exchange traffic with all other core backbone providers on a settlements-free basis (essentially a "bill-and-keep" system); interconnect at a minimum of five major national access points (NAPs) and on a private bilateral basis with other backbone providers and ISPs; and offer high-speed transmission facilities that connect their nodes and that transmit high volumes of Internet traffic both nation-wide and globally." Sprint Corporation, "Comments of Sprint Corporation In the Matter of Applications of WorldCom, Inc. and MCI Communications Corporation for Transfer of Control of MCI Communications to WorldCom, Inc.; CC Docket No. 97-211," March 13 1998, at 6.

"Currently, there are four core backbone providers: WorldCom, MCI, Sprint, and GTE (through its ownership of BBN)." *id* at 7.

[55] This is true for both inter-ISP connections and intra-ISP (e.g. between an AOL POP in Arizona and one in Virginia). Generally, these lines are leased from an IXC.

[56] See Appendix for the basis of these calculations. Although these figures come from the same model used to estimate business expenditures, they are more precise because there are fewer areas of uncertainty.

I was able to "check" the model against published information:

expenditures on telecommunications services are incremental telecommunications services expenditures directly derived from demand for online services. These estimates imply cumulative past ISP expenditures on local access of $1.1 billion to $1.8 billion.[57]

One significant factor in determining ISPs telecommunications services expenditures on connections to LECs is the type of access used by business: the lower estimate assumes all business users connect via dedicated lines to their ISPs; the upper estimate assumes all business users are dialing-in via the PSTN.[58]

Essentially all smaller ISPs use leased lines to connect to other ISPs. Most of the larger ISPs also used leased lines for their backbones. For example, both ANSnet, now part of Worldcom's family of core backbone providers, and PSInet use leased lines to construct their national backbones.[59] The lines are leased from telecommunications carriers, generally IXCs, and the lease revenues generate incremental USF contributions. As traffic grows and ISPs add capacity on their various connections, incremental USF-generating revenue is earned by the IXCs and other line providers.

An ISP leasing backbone capacity from an IXC likely uses a "Special (Non-Switched) Digital" access line to connect to the IXC POP. These lines are likely also used by business end-users who have direct connections with their IXC.[60] The utilized capacity of these lines in 1996 was 238% of the utilized capacity in 1993.[61] It seems doubtful this increase in demand was driven by

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Pacific Bell had 2.3 million Internet subscribers in 1996, 80% of whom were residential. Pacific Bell said these users, residential and business combined, averaged 45 minutes per day online. Pacific Bell actual revenues from ISPs for local connections were $36 million in 1996. When I use these values in my model, I get ISP expenditures on local connections between $22 million and $28 million annually, with a point-estimate of $24 million. This suggests my model is conservative, provided I have good estimates about the number and characteristics of online subscribers.

1996 Internet subscriber data in Pacific Bell service area: Pacific Telesis (1997). Pacific Bell 1996 ISP revenue figure from Fitzpatrick, Michael, "Remarks of Michael Fitzpatrick," 23 October 1996. http://www.pactel.com/about/mgnt_perspectives/fitz102396.html [accessed 1/30/98, web site now being remodeled].

[57] Again, these are merely 1.64 times my 1998 estimates (see fn. 48).

[58] For example, if all business users have dial-up connections to ISPs, the LECs receive very significant per-minute revenues from business and the ISPs need to have sufficient LEC-to-ISP capacity to handle the business users. On the other hand, if all business users connect directly to ISPs via leased lines, LECs don't receive the local per-minute revenues and the ISPs have fewer dial-up connections to the LEC central office. Instead, business users make lease payments to the LEC or some other telecommunications carriage provider. Thus, businesses' dial-up versus leased line decisions have considerable impact on the ISPs' local connection costs.

There are additional differences in assumptions between the two estimates - see Appendix.

[59] For example,

- "ANSnet 'How we do it'," http://www.ans.net/, 19 January 1998.
- "Technology and Infrastructure," http://www.psi.net/network/techinfra.html, 1 March 1998.

[60] That is, businesses who bypass the LEC switched network for some of their long-distance traffic. This could be as part of a private network.

[61] That is, 1996 utilized capacity was nearly 2.5 times (238%) the 1993 utilized capacity. This time period is sufficiently removed from AT&T's divestiture, and precedes the 1996 Telecommunications Act, suggesting neither of those events are driving this dramatic growth. *SOCCC* 93-96, Table 2.5

demand for voice communications: over the same time period, interstate toll DEM increased only 26%[62] and the number of interstate toll calls was up only 35%.[63]

It is difficult to quantify ISPs telecommunications services expenditures for backbone. Some of these expenditures are on intrastate private lines,[64] making it more difficult to collect the necessary information. It is likely the FCC has available, in filings relating to the WorldCom-MCI merger, considerable information that would assist in quantifying the telecommunications carriers' revenues from ISPs' backbone leases.

I would very roughly estimate current backbone expenditures at $1.3 billion to $2.2 billion per year with historical expenditures between $2.1 billion and $3.7 billion.[65] These figures exclude all ISP expenditures on international telecommunications services used for international backbone provision.

D. ISP Services

It is generally not possible to map specific ISP services to specific telecommunications services inputs. For example, if my assistant and I subscribe to the same (locally-based) ISP, e-mail between us will involve only the respective local connections between each of us and our common ISP. However, e-mail between me and a colleague at, for example, the University of California at Berkeley, might involve several ISPs and will involve several thousand miles of fiber optic transmission lines. Similarly, editing my web page or downloading ISP-supplied software might be a "local" transaction if I use a local ISP or it might be involve interstate transmissions if I am a major corporation purchasing web-hosting services from a specialist ISP.

This means an ISP cannot determine whether it is selling "local" or "interstate" information services based on what application a customer is using. As described in my earlier comment in this matter, it would be difficult and expensive to distinguish between "local" and "interstate"

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[62] *Trends* 98, Table 11.1.

[63] *SOCCC* 93-96, Table 2.6

[64] For example, smaller ISPs connecting to local POPs of larger ISPs, larger ISPs connecting to core ISPs' nodes and core ISPs connecting to NAPs as well as their connections among nodes within a state.

[65] This estimate is loosely based on a model developed at MIT. That model estimated various categories of local and backbone telecommunications services expenditures. Excluding interconnection expenditures (e.g. connections to NAPs), the amount the model calculated for a hypothetical national ISP's backbone expenditure was 2.6 times the amount it spent on local telecommunications services. The lower estimate for backbone expenditures given in the text is 2.5 times my lower estimate for 1998 local expenditures; the upper backbone estimate is 2.6 times my upper local access estimate. Note, however, that the $4.23 per-line increase in SLC/PICC charges that came into effect in 1998 was deducted from the local expenditure estimates when estimating backbone expenditures because Leida's model uses pre-1998 access pricing. Leida, Brett, "A Cost Model Of Internet Service Providers: Implications For Internet Telephony And Yield Management," MIT Department of Electrical Engineering and Computer Science, 1 November 1997.

Historical expenditure estimates are 1.64 times current estimates. See fn. 48.